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MOTOR TRANSPORT IN CAMPAIGN

PREPARED BY THE WAR COLLEGE DIVISION, GENERAL STAFF CORPS AS A SUPPLEMENT TO THE STATEMENT OF A PROPER MILITARY POLICY FOR THE UNITED STATES

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MOTOR TRANSPORT IN CAMPAIGN.

I. INTRODUCTION.

The past 15 months of war have resulted in verifying in every respect the predictions of military writers of late years. All pointed out that nature and science would be called upon to serve mankind in many practical ways, and that achievements then (at the time of writing) in their infancy would, under the stress of war, develop into aids which would be found to be of far-reaching importance.

Such of these predictions as relate to the use and application of motor transport have been found to be correct, and this is shown primarily through its improvement and development, but lastly by the fact that it has become absolutely essential to the efficient prosecution of a campaign.

1. GENERAL CONDITIONS OF EMPLOYMENT.

Modern weapons of offense and defense, such as large-caliber mobile artillery, the machine gun, and the aeroplane, have exercised a marked and direct influence on combat in general. Strategy has been affected by the altered conditions affecting the battle, and even the conduct of an action has been influenced. Along with the use of motor transport, which altered the aspect of warfare, both in countries with good highways and in those which lack them, comes a speeding up of the rate at which military operations can be conducted. The strategic mobility of troops has been increased, and this fact will bring about greater ease in the grouping of forces for the battle.

Indirectly they promote "the independence of the troops of their lines of communication, by facilitating the bringing up of supplies and by creating possibilities for concentration and movements which did not formerly exist. Commanders acquire thereby greater freedom of action."

It must not be assumed, however, that the methods of warfare have been revolutionized through the use of motor transport. When the war is over and the newspapers have ceased to announce in big headlines the wonderful achievements of this type of transport, we shall undoubtedly find there are many limitations to be placed on its use. However, there is no doubt that it has aided in a remarkable way the supply and transport of troops.

What may have been found feasible on the western front might not have been found possible in the plains of Galicia and Poland. Difficulties connected with the repair and supply of fuel have limited the use of this transport in a number of cases, but no definite rule can as yet be deduced from the special cases which are set forth in the press and in the popular magazines.

2. VARIOUS TYPES EMPLOYED.

The history of the present war indicates conclusively that all attempts to employ a special type of car or truck for service have ceased. The type of truck or car ordinarily in use in the particular theater of operations before hostilities offers the most adaptable and suitable transport for war in that theater.

In France no attempt has been made to use any particular type of either automobiles or motor trucks, but the Government has taken what it could get from the principal manufacturers. As far as possible, endeavor is made to have all the motor trucks of each army the same make.

Various American trucks have been found excellent in every way, and a light chassis for ambulances is rendering the best service. These can go where heavier vehicles in many cases could not pass, and where they would only encumber the road.

It seems to be generally conceded abroad that the trains corresponding to our field and combat trains should be horse drawn, while the division, corps, and army trains are best constituted of motor transport. There are to be found some exceptions to this rule, but, generally speaking, the official reports are a unit in this respect.

3. MOTOR TRUCKS—USES, CAPACITY, PERSONNEL.

The corps trains, for instance, in the French organization correspond to our divisional trains (supply, ammunition, sanitary, and engineers' trains), have in part been replaced by motor vehicles. The supply train still remains animal drawn, with the exception of that part of it engaged in taking forward beef from the slaughtering points to the regimental train (their meat wagons). The ammunition train remains equipped with animal-drawn caissons. As previously explained, these caissons must often pass off of the metaled roads and travel through fields so as to supply combatant units. Ammunition is pushed up much closer to troops by auto trucks than was the case in previous wars. The étape or link therefore to be covered by the caisson is not as great as it used to be. However, the expenditure of artillery ammunition is much greater than was ever contemplated, and the saving of the road space in the length of the étape or link has been more than compensated for in the

additional number of trips these vehicles must make. The very large caliber guns are not assigned to the corps, but are part of the army artillery. The size and weight of the ammunition of some of these guns make it practically necessary to replace their ammunition by motor trucks. These guns themselves are so heavy as to make it necessary to carefully pick out the ground over which they are taken into position. They are not mobile in the sense of the guns with the corps and some of the lighter type of heavy guns with the army. Their position is also such as to make their resupply in ammunition much simpler than the smaller guns.

The sanitary trains have been greatly supplemented by the attaching of automobile ambulances directly to these trains, in addition to the animal-drawn units. Although not known definitely, it is believed that some of the animal-drawn elements of this train have been suppressed. The more rapid evacuation of the wounded by automobiles and the distance the automobile can cover has cut down considerably the number of "ambulance immobilizé" (field hospitals) with the corps.

It has been ascertained that to-day the number of automobiles of different classes with the different armies varied somewhere between 2,500 and 4,000 with each army. Aside from the touring cars assigned permanently to different headquarters and the auto trucks and ambulances assigned to the corps and those assigned to special service, such as the aviation service, etc., the balance are attached to the army. They form what might be called the automobile convoy of the army, and they are either temporarily assigned for certain specific work to corps and divisions or are used in pushing supplies and material forward to troops from railheads. The formations of the different "parks" attached directly to the army correspond generally to the formation laid down in our Field Service Regulations for Columns. It is believed that after the war is over and as the auto truck develops in efficiency that the effort will be made to reduce the size of trains with the divisions and corps, and by means of what we call "columns" to push supply and evacuating points closer up to the troops. The English have perhaps gone further in this particular to-day than the French, but it is thought that, with a well-trained personnel and efficient direction, the results that would obtain under this system would be better than the old.

Any intelligent person can foresee that at some future time animal-drawn vehicles with an army will disappear. However, to-day, when roads are not good and when from one reason or another certain vehicles supplying troops must pass off these roads into the field, the animal-drawn vehicle still has its advantage and must of necessity be retained.

In France the roads are excellent and are well kept up. In the Vosges a number of new roads are being constructed. These latter roads are all permanent and beautifully installed.

Notwithstanding these fine roads in France, the combat and field train of combatant units in their entirety, as well as a large portion of their corps train (our division trains), remain animal-drawn.

There seems to be no doubt that when we consider the road conditions in our possible theater of operations we will not be able to change to the motor truck until a much later date than the European army. This will undoubtedly be the case, unless a great advance is made in automobile construction. While the authorities always have been great believers in auto trucks and are satisfied that in time of war we will have need for them in the thousands, it is believed that the development of an efficient auto truck for combat and field train purposes goes hand in hand with the development of an efficient farming auto truck. When an auto truck has been developed that will bring in the average farmer's crop from his fields we will have an efficient auto truck for combat and field train purposes.

One of a great number of uses of auto trucks to-day is to move troops promptly into a threatened sector of the line of trenches. In one operation each division had temporarily under its orders 50 auto trucks for moving troops. These trucks were kept with the reserves. Each truck could carry 20 equipped infantrymen. By the use of these trucks and within a very few minutes 1,000 men could be loaded and moved to the threatened point. With this load and moving at the rate of about 12 kilometers an hour, it would not take long to commence throwing in reserves. These were only a few of the auto trucks that the army had. If the situation became more serious, then additional trucks could also be used for the same purpose.

There is no question but that in other theaters of war, when a war of maneuver has been carried on, these trucks have been used to carry troops on raids accompanying cavalry. The supply trains with cavalry have also been made up of the transport.

The animal-drawn army trains or grand parks, except certain vehicles of the artillery and engineers, have been entirely done away with and their work done by the army automobile convoy.

On the line of communication and in the zone of the interior practically all the transportation in general use is motor-drawn.

The escort wagon has somewhat the same drawbacks as an auto truck when it comes to moving off the roads and in the fields. During this war certain troops could not have held positions had they not a vehicle of resupply that was capable of getting off a road covered by hostile artillery fire and passing through fields under cover to near the troops. It is believed that we should give some serious

study to the working out practically of this question of a suitable type of combat train wagon.

The heavy auto-truck companies are often supplied with trailers, the trailer having the same carrying capacity as the truck. This type usually carries 3 tons, but for all-round service a 1½-ton truck has been found most acceptable. The use of trailers, however, must depend upon road conditions, and where good road conditions do not exist the strain on the truck is so great as to render the use of the trailers with the truck not advisable.

The number of auto trucks is usually fixed by the number of vehicles required to transport either one day's rations for a corps (125 tons) or two "lots" of ammunition, infantry and artillery (160 tons). The trucks are expected to make 12 miles an hour and to be able to travel about 100 miles a day.

The personnel with an auto-truck company varies, but it is not far from the organization prescribed for our motor-truck companies. (See Tables of Organization.)

The use of motor transport has reduced, by many men, the personnel of the service of supply, thus releasing a greater number of men for the firing line. In the past, during some wars, the number of men required behind the lines was equal, if it did not exceed, the number of fighting men.

4. AUTOMOBILE PARKS.

The extended use of automobiles of every type in the present war has created some new problems, one of the most important being the maintenance of the various motor wagons in a condition for service. Although the reliability of motor cars has been enormously improved in recent years, they, more than most machines, are subject to many ills and troubles.

Motor-car troubles may be conveniently grouped under three heads: Ordinary road troubles, such as can be repaired by chauffeurs or mechanicians with the simple tools and repair parts carried for this purpose; second, more serious troubles, which call for shopwork; third, very serious troubles, which call for factory work.

In order to meet satisfactorily the second class of troubles, those calling for shopwork, recourse is had to the organization of so-called automobile parks, one for each field army. Like many other features of the present war, the automobile park is a new creation called for by the emergency of the situation. The number of automobiles of all kinds assigned to the field armies varies according to the conditions, such as size and extent of front of the army, character of country as regards available roads and railroads, etc. The automobiles assigned to each army are numbered serially, and

by observing the numbers noted at different times and places a fair idea of the number of machines belonging to a field army may be obtained. This number averages not less than 2,500 per field army, including both passenger and freight autos. It is evident that with so large a number of machines constantly doing hard service there will be need for some organized and controlled scheme for repairs. This is the task of the automobile park.

In a populous region where position warfare has obtained for some time the problem is easy. Existing garages or machine shops in conveniently located towns afford all necessary requisites for an automobile park and permit of undertaking repairs on a large scale. On the other hand, where field warfare has been the rule and where large industrial towns and villages are lacking, the problem is more difficult, requiring, in the first place, that the repair park have a certain amount of mobility and also that it carry along its equipment and appliances. Under these conditions the repairs that can be undertaken in the field are more limited.

Supposing a field army to be established in some garrison camp, its personnel would be housed in the barracks of the peace garrison. If no suitable buildings were available for shops and garages, suitable light-frame structures are erected, arranging the buildings by centering the repair departments around the sides of a rectangle, with open sheds in the center for housing machines repaired and awaiting repairs.

The various shops are a carpenter shop, painting and glazing shop, machine shop equipped with power lathe, shaper, emery wheel, drill press, etc., a vulcanizing shop, a blacksmith shop, and an oxy-acetylene welding outfit. The latter is a most useful affair, enabling broken parts of steel, brass, and even aluminum to be welded together. There is also a small printing shop for printing various blank forms used by chauffeurs in recording car performances. A large stock room containing spare parts of all usual makes of automobiles forms part of the park and enables repairs to be made very quickly.

About 200 cars are usually on hand at the park, some pretty bad cases among them, including several which had suffered from shell fire. With appliances available quite serious repairs can be undertaken without returning cars to factory. A supply of repaired cars in running order is maintained from which issues can be made in exchange for cars turned in for repairs.

The personnel of the park consists of one captain, taken from the railway regiments; two lieutenants, one from the cavalry and one from the artillery; and about 400 men drawn from recruit depots, and most of them skilled workmen.

5. THE ARMORED CAR.

The weak point in the comparatively heavy armored car lies in its dependence on the condition of the road and its helplessness before ordinary obstacles, such as ruts and ditches. It has its uses, however, under the conditions noted in the following remarks:

In the German invasion of Belgium * * * motor vehicles apparently played an enormously important part in enabling the enemy to push forward more rapidly than he could have done had he had to depend entirely on his cavalry. The armored car early proved its value for this sort of patrol work. It exercised another influence on the cavalry arm, in that, by expediting the rate at which it was possible for the invader to push forward, it placed correspondingly a greater strain on the mobility of cavalry, and to that extent used up the horses of the enemy at an additional rate, as instance the extremely ill condition into which they got last autumn.

Thus in this connection the advent of the motor vehicle to modern warfare made possible operations beyond the scope of cavalry unaided, and at the same time put a greater strain on that arm. It has also speeded up the movement of the main armies, because, unlike horses, motor vehicles do not tire during the spells in which it is possible for men to work them.

6. MOTORCYCLES.

These have generally proved unsatisfactory, and for messenger and orderly service they have been replaced by the light motor car. Light 4 or 5-horsepower, two-passenger cars, like the Bébé Peugeot and the Zebre, can go almost anywhere.

In some newspaper reports and in letters from the front rumors of the use of a large number of motorcycles to move troops occur, but no verification of this has ever been received through official channels.

Based on these reports an organization of a large number of motorcyclists has been proposed, with a view to their use in place of cavalry. Notwithstanding the comparative invisibility of the motorcycle and its individual adaptability to a varied terrain such a plan appears unfeasible. In the first place the men would have to be trained as soldiers before they can become military cyclists, and, in the second place, no teamwork of the mass could be assured without some training of the whole as a body.

Companies for duty at Army corps or division headquarters are feasible, but it is not believed that large bodies can operate with the same ease as cavalry. It is safe to assert that during operations in Courland a motorcycle corps of 60,000 could not have replaced that amount of cavalry or have done the work expected of them.

7. USE IN COUNTRIES HAVING FEW ROADS.

Perhaps the phase which has most vividly brought home the change wrought by the advent of the motor in the conduct of military operations has been its employment during the campaign against De Wet.

The average mind can here appreciate the advance made by the present-day methods of warfare, as the scene was identical in nature with that of 15 years ago, when something in the neighborhood of a quarter of a million British soldiers were engaged in rounding up De Wet and his Boers. There is, however, this difference, that, while the numbers concerned were much smaller than in the campaign referred to above, the uprising led by De Wet was in the nature of a surprise, which made the mobilization of the necessary troops and the accumulation of supplies impossible in advance of the emergency. The hostile Boers in this instance had precisely the same mobility which enabled them to elude the British troops so easily 15 years ago.

The difference in the later campaign is shown by the fact that motors were employed instead of horses and horse-drawn transport.

But these cars were not built for military use, being merely machines owned by members of the Johannesburg Automobile Club, many designed for use only on roads as we understand them in Europe. The work in hand, however, required that the cars should be driven across country in all manner of directions, over the veldt where there chanced to be neither road nor track, and across the beds of rivers.

Moreover, the vehicles usually carried something more than the normal load. Scarcely two cars were of a kind or model. Thus, from the point of view of military service, it would have been impossible to select anything in the way of motor vehicles less suitable for the task. Of course, many of the cars broke down, as they are breaking down every day in the war area in Europe. But the thing that counted was that more cars got through than fell out of the running, while of those that failed it must be observed that up to the point at which it broke down each assisted to keep the enemy on the run. To that extent it did its work toward rounding him up.

8. AMBULANCES.

Motor traction has worked wonders in this war with the food and ammunition supply, yet in each one of these services the final stage is still made by horse-drawn vehicles. However, under the existing conditions of trench warfare the sanitary service has gone even further and have supplanted all slow-moving horse-drawn vehicles by light and efficient motor ambulances.

The motor ambulance is the machine for which the ordinary pleasure car chassis, unaltered, has proved most suitable. The provision of these ambulances has undoubtedly contributed enormously to the saving of life and suffering. But the best of them scarcely begins to realize the possibilities of a motor vehicle for this service in regions in which roads are either lacking or

are torn up as a result of warfare. They are no longer using ambulances having the excessive overhang so common among those presented at the beginning of the war. But that is only a slight improvement, for even to-day the driver of the average motor ambulance sits in the best swung position. At least part of the patient's body as he lies flat—usually the feet and the lower part of the legs—projects behind the back axle.

Nor should motor ambulances have too long wheel bases, because it is often necessary to turn them in brief compass. Obviously the driver should not be placed where he sits in an ordinary touring car or town carriage. If the motor must be accommodated in the same part of the chassis, then the ambulance driver and the attendant seated beside him should be placed above the engine, as they are in certain types of French and German motor buses.

This arrangement would enable the best part of the chassis ordinarily occupied by the driver to be used by the patient, the whole of whose body could accordingly be brought well between the two axles. There is nothing to the speed at which these ambulances have to be driven that would render it undesirable to accommodate driver and attendant above the motor. Nor is this all, for the present system of springing is at best a mere combination of makeshifts, in that all springs are the result of building up laminations of steel plates.

Each spring so built up can give the smoothest riding only at certain vibrations and certain loads, whereas the whole point of having a motor vehicle for any sort of service is that you can use it either with full load, with part load, or without any load; also that you can drive it over any sort of surface at any speed of which it is capable, from the slowest to the fastest. No form of laminated steel spring can therefore be quite suitable for the purpose. Possibly pneumatic suspension will prove a successful solution of the problem.

These motor ambulances, under cover of darkness, come right up to the dressing stations and evacuate direct to the clearing stations, which are back at corps headquarters in some suitable building. It is due altogether to these swiftly moving ambulances that wounded can be forwarded to the base and finally to England. A man if wounded in the forenoon is out of luck, but the man wounded in the afternoon may reach a hospital in England before his name reaches his corps headquarters as among the wounded.

9. FUEL.

Sufficient data do not yet exist from which we can state definitely the various kinds of fuel employed. Among those mentioned are alcohol, benzol, kerosene, and gasoline. Shortage in gasoline and increase in the price will undoubtedly cause a search for a new fuel. Its arrival is certain, as there has never been a crying demand for any improvement without an answer from the engineers and inventors. Improved carbureters and lighter cars show, in a way, the line of advance of improvements.

With the export demand, the war, and the domestic demand, there does not seem to be much thought of lower prices for gaoline. While kerosene could be used and would be cheap, it has, up to this time, exhibited a tendency to give off an odor when burned and it also

leaves an excess of carbon in the cylinders. The low grade of gasoline is a little more difficult to start on, but it supplies more heat and is a better fuel for general work after the motor is under way.

Some moderately successful attempts have been made in this respect, but, although the cost has been reduced to 7 cents per mile, a great deal of trouble exists because of the sediment left in the carbureter. This may, however, be remedied by study, and we may have a new less expensive fuel before long.

Thus the war has speeded up the development of the motor car, permanent improvements will result and, perhaps, a new fuel.

10. DEFECTS IN CONSTRUCTION BROUGHT OUT UNDER THE STRAIN OF ACTIVE-SERVICE CONDITIONS.

Lack of standardization of parts and the continual breaking of radiators are mentioned as being the main troubles encountered in handling this kind of transport. The last trouble undoubtedly comes from the shock due to bad roads and to continued use without an opportunity for repairs or rest.

For the student who has studied carefully the development of this transport the most gratifying thing about remodeling the proposition of modern warfare, made possible by the arrival of the motor vehicle, is the fact that every accomplishment and every success, up to date, stands to the credit of machines neither specially designed nor produced for war purposes.

WHEELS.

The wheels giving the most satisfaction are those in which a steel plate replaces the spokes, and where the dual tire is of solid rubber. This has been tried out in several trucks and found serviceable.

LIGHTING SYSTEM.

The "Prestolite" system was not serviceable nor satisfactory, and electric lighting found much better in every way. The feature reported on as being successful in every way was the movable headlight. It is of great use when loading and unloading at night and while off the main road and parking the machines. A good electric headlight arranged on a universal joint and within reach of the driver has been spoken of as an ideal arrangement.

BRIDGES.

Closely connected with the use of motor transport comes the importance of good roads, and next the question of bridges and a study of the means to be taken to strengthen the highway bridge ordi-

narily encountered in this country. Heavy ordnance, together with a continual stream of motor transport, will without doubt test the average highway bridge in many probable areas of operations. The development of heavy ordnance has called for the use of the motor in its transportation. There is plenty of information on hand to show that the transport of heavy ordnance, away from the railroad lines, has been accomplished by special motor vehicles.

11. RESULTS OF THE WAR.

The export of motor vehicles in the past two years has moved forward with a great bound. In 1915 it amounted to $100,000,000, while in 1914 it was $28,507,464, an increase of 250 per cent. The estimated value of commercial vehicles exported was $63,000,000 of the total. England has been the best buyer of automobiles from the United States. Her purchases amounted, for the fiscal year ending June 30, to 5,306 trucks. France and Russia also were heavy purchasers. When the war ends there must needs be an immediate readjustment of the great industries of the belligerent countries. Hence it is believed that there will be left in the hands of many of our manufacturers trucks of the latest pattern. Why should we not use them to form the cadres for our divisional and Army transport, and accustom not only the troops but a number of officers and men with the use, handling, and repair of motor vehicles?

The following quotation, taken from a foreign motor publication, shows that this question has already been agitated in France:

> Among the problems that are apt to come up at the close of the war in Europe is the means to be taken by the belligerent nations in disposing of the motor trucks now in use by the armies. France apparently has formed an answer to the question already. At an auction held recently, 740 of the Paris internal-gear drive omnibuses mobilized at the beginning of the war were sold, to be replaced by an equal number of similar chassis for work at the front. By selling these chassis at this time to private owners it was possible to forestall the purchase of that many chassis from neutral nations.
>
> Another benefit to France is that this method of selling French trucks that have seen service prevents the beginning of an installation of foreign chassis by large owners who might after the war, in the interest of standardization, continue their purchases of trucks made outside of France.
>
> The foreign trucks now used by the French Army are run until they are useless and can not be overhauled advantageously, and are then replaced by French-made chassis, the latest advices from France being that the factories there are now in a position to care for the army's needs.

12. CONCLUSIONS.

The question is at once asked whether or not we have taken steps to use this transport and to avail ourselves of the large amount of suitable material existing to-day in the United States.

The answer is made that this has been done as far as existing appropriations will allow. However, most of these vehicles are operating singly or in pairs, and at no one place are there sufficient for one company.

13. ORGANIZATION.

The organization proposed for a motor-truck company conforms to the experience of officers abroad, but as yet no attempt has been made to collect the material of automobile parks or for repair shops and these are shown by the experience of all to be badly needed in field operations.

The assignment of this transport to the divisional trains is correct and conforms with the practice abroad.

There should be organized in each division a motor-truck company, and attached thereto a repair shop. This organization will form a cadre as well as a place where chauffeurs and mechanicians can be trained. It is true we can recruit plenty of men from this class when war is imminent, but it is one thing to be a chauffeur and another to be a military chauffeur.

Abroad this defect does not exist, but with us something should be done to remedy the lack of disciplined material. The experience of certain of the belligerents in this respect will be ours if we become involved in war.

14. COLLECTION OF THIS TRANSPORT.

Based on the type of vehicle *in use* in the cadre in each division, attempt ought to be made to arrange for a large number of vehicles *of a similar type.* The same type of vehicle, as far as possible, should be used within a division or even a field army if such can be accomplished.

The Federal Trade Commission could under the law obtain the data, in each divisional district, necessary for listing suitable transport. The Quartermaster General's Office has prepared a provisional plan for utilizing motor transport, under existing laws, and this plan includes a contract system which will take the place of the prizes and subsidies that have been found so efficacious abroad.

All these steps are in the right direction, and we have conserved the underlying principle for the use of mechanical-driven transport, and this is that it is a transportation unit pure and simple. It picks up a load at one place and discharges this load upon arrival at destination. It is not employed in transporting mobile reserves. The animal-drawn vehicle transports the rolling reserve. Animal-drawn vehicles are still being purchased in great numbers by the French. A recent order has been placed for over 4,000 of these wagons. The French have not as yet replaced the animal-drawn

transport of combat and field trains with autotrucks, nor do they apparently intend to do so. The corps supply, ammunition, and sanitary trains remain animal-drawn, except that automobile ambulance sections form part of the sanitary train, and fresh-meat automobile sections form part of the supply train.

The foregoing facts are striking when we consider the excellent roads being maintained in the theater of operations. The animal-drawn vehicle will undoubtedly be eventually replaced by mechanical-driven transport. However, before this can be done, even in Europe, many mechanical imperfections at present existing in the autotruck must be overcome. Our problem in this particular is more difficult than the European, when we consider the roads and bridges in our probable theater of military operations, and it is very possible that we will not be able to make the change until some time after it has been effected in Europe. Notwithstanding the fact that it may be some years before we can use autotrucks in our first and second lines of transportation, the fact remains that, in the event of a war, we will have need for this kind of transportation in great quantities behind our second-line transportation.

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